mercial treaties or otherwise to secure an effective and permanent control or command of an adequate supply of phosphate rock, and that arrangements should be made in advance for the importation of large quantities of phosphate rock immediately on the termination of the war."

There is more in this recommendation than meets the eye. Certain of the forfeited Colonial possessions of the Germans contain valuable deposits of phosphate rock, and others are known which ought to be, and doubtless would be, exploited if a demand were created. It is to be hoped that the Government may be in a position to act promptly upon this recommendation, and thus enable at least some portion of the large and valuable plant created by the war to be utilised before it is too late, for the benefit of chemical industry and the welfare of agriculture.

NOTES.

THE Marconi Wireless Telegraph Co. is to be congratulated on having established experimental wireless telephonic communication between Clifden, Co. Galway, in Ireland, and Cape Grace, in Canada. This is not surprising after the company's feat last year of establishing wireless communication between England and Australia—a distance of 12,000 miles. The improvements which have been made in thermionic valves—for instance, the reduction of the air-pressure in the valve to the one-hundred-millionth of a millimetre of mercury—have increased their sensitivity enormously. In addition, by connecting them "in cascade" there appears also to be no limit to the sensitivity that can be attained. The Australian results were obtained by using three small Marconi Q-type valves in cascade. Wireless telephonic transmission is specially interesting, as it is free from many of the defects of ordinary telephony, in which sound distortion presents serious difficulties over long cables. There seems no reason to doubt that in a short time wireless telephony will be established between every country on the globe. The necessity for well-thought-out international laws to regulate this traffic is therefore pressing.

VISCOUNT HARCOURT deserves the thanks of all interested in the restitution of our museums for his persistent worrying of the Government and for his letter to the *Times* of March 22. In answer to his question on March 19 he was informed that the London Museum would be restored to the public in a few weeks. "Temporary buildings are to be erected in the suburbs for the staffs now in occupation" of the Imperial Institute and the Tate Gallery, "but the new accommodation cannot be available for at least six months." The Education Department, it is expected, will soon return to Whitehall. There is, however, "no immediate prospect" of vacating the National Portrait Gallery, Hertford House, or the remaining galleries of the National Gallery and the British Museum. As regards the last institution, an article in the *Times* of March 21 did well to remind the public that the greater part of the old building is now accessible. The situation, no doubt, is difficult, as Sir Alfred Mond has explained in a long statement to the Press, but the agitation has succeeded in speeding up the Government, and once more we may exclaim, "Thank God, there is a House of Lords!"

THE absence of recognisable meteorites from the series of stratified rocks is a notable fact, possibly due to the disintegration of the meteoric substance, which even in our museums displays a deplorable tendency to decay. The British Museum has, however, recently acquired among slices and fragments of various recent falls or finds a slice weighing 362·5 grams of the meteoric iron which was found in January, 1905, on Claim No. 7, Skookum Gulch, 9½ miles S.E. of Dawson, Klondike. This, as well as another meteoric iron found in 1901 on Gay Gulch, in the same neighbourhood, was lying deep down in the so-called "white-channel gravels," which are the oldest high-level gravels of the district, and are believed by Mr. R. G. McConnell to be of Pliocene age or older. The original specimens are in the Museum of the Geological Survey at Ottawa, where they have been examined by Mr. R. A. A. Johnston (1915), who infers from their similar structure and composition that they formed part "of a single meteoric shower which took place back in Tertiary time."

AN address on "Acute Pneumonic Tuberculosis" will be delivered by Sir W. Osler before the Tuberculosis Society at 8.30 p.m. on Monday, April 28.

NEWS has reached us of the death on March 8, at thirty-seven years of age, of M. Jacques Danne, editor of the well-known French journal *Le Radium.*

WE learn with regret from Tuesday's *Times* that Sir E. C. Stirling, F.R.S., professor of physiology in the University of Adelaide, and director of the South Australian Museum, died on March 20 at seventy years of age.

NEXT Thursday, April 3, Prof. A. Findlay will deliver the first of a course of two lectures at the Royal Institution on colloidal matter and its properties. The Friday discourse on April 11 will be delivered by Sir J. J. Thomson on piezo-electricity and its applications.

THE Paris correspondent of the *Times* announces the death on March 19, at seventy-seven years of age, of Prof. F. H. Hallopeau, member of the Paris Academy of Medicine, and author of a treatise on general pathology and numerous papers on therapeutics and dermatology.

THE death is announced, in his seventy-sixth year, of Prof. Charles L. Doolittle, who was professor of astronomy at Lehigh University from 1875 to 1895, and at the University of Pennsylvania from 1895 to 1912. Prof. Doolittle was treasurer of the Astronomical Society of America from 1899 to 1912, and was the author of notable papers on the variation of latitude, the constant of aberration, and related subjects.

THE Regional Association will hold its next conference at Malvern on April 9–16. The object of the conference is to study the Malvern region from the physical, historical, and social points of view and to facilitate the interchange of ideas of all who are interested in the study of their environment. A series of lectures and excursions has been arranged. The local secretary is Mr. E. W. Harris, The High School, Malvern. The first annual report of the association, a copy of which has been sent us from the office, 11 Tavistock Square, W.C.1, shows that a considerable amount of work has been done in the past year in spite of difficult circumstances. In many parts of the country the intensive survey of regions has been undertaken. It is hoped that some of these surveys will soon be ready for publication in view of their important bearing on local schemes of social betterment and reconstruction.

THE annual general meeting of the Ray Society was held in the rooms of the Geological Society on March 13, the president, Prof. W. C. McIntosh, in the chair. Resolutions of regret at the death of Dr. F. Du Cane Godman, treasurer for fourteen years, and of Canon A. M. Norman, a former member of the council, were passed. The treasurer, Dr. S. F. Harmer, was congratulated upon his appointment as director of the Natural History Museum. It was announced in the report of the council that vol. iv. of the "British Fresh-water Rhizopoda and Heliozoa," by G. H. Wailes, was ready for binding, and that the "British Orthoptera," by W. J. Lucas, and vol. i. of the "British Charophyta," by James Groves and Canon Bullock-Webster, were in the press. Prof. E. B. Poulton was elected a vice-president, and Dr. A. W. Alcock, Dr. G. B. Longstaff, and Mr. A. W. Oke were elected new members of the council. Prof. McIntosh, Dr. Harmer, and Mr. John Hopkinson were re-elected to their respective offices of president, treasurer, and secretary.

ON March 18 the Illuminating Engineering Society held its tenth anniversary dinner, the president, Mr. A. P. Trotter, presiding. The toast of the society was proposed by Mr. Thos. Goulden, senior vice-president of the Institution of Gas Engineers, and seconded by Mr. C. H. Wordingham, president of the Institution of Electrical Engineers, both of whom referred to the valuable, impartial platform which the society affords for the discussion of topics of common interest to both gas and electrical engineers. In replying to the toast, the president remarked that the society's activities have expanded continuously since its foundation, and it has frequently brought together those interested respectively in the design and manufacture of lighting apparatus and those who use it. Mr. F. W. Goodenough proposed the toast of kindred societies, represented at the meeting by the Royal Society, the Royal Society of Arts, the British Science Guild, the Council of British Ophthalmologists, the Royal Institute of British Architects, the Institutions of Gas, Electrical, and County and Municipal Engineers, and the Electrical Contractors' Association, on behalf of which Sir George Beilby, Col. J. Herbert Parsons, and Mr. A. A. Campbell Swinton replied. Mr. Gaster, in proposing the toast of "The Guests," referred especially to the important report issued by the Home Office Departmental Committee on Lighting in Factories and Workshops in 1915, and expressed the hope that in the near future there will be definite legislative reference to the provision of adequate lighting in factories in the interests of health, safety, and efficiency of work. In the United States such legislation has been adopted by five of the States, and it is to be hoped that this country, which took the initiative in this matter before the war, will regain the lead.

IN an article entitled "International Use of Patent Searches," published in the Journal of the Patent Office Society for February last, Mr. Scott H. Tilly directs attention to a wish expressed in an address given by the director of the Canadian Patent Office to the employees of the United States Patent Office to the effect that the Canadian Patent Office might officially have the benefit of searches made in the United States in respect of any matter in relation to which applications are also filed in Canada. It is argued that, since the great majority of applications filed in Canada are filed in substantially the same form in the United States of America, one search as to novelty should be sufficient; and further, since the facilities for search are better in the United States than in the Dominion, the single search suggested should, in the interests of economy and efficiency, be conducted at Washington. Mr. Tilly desires to see the matter carried further still, and suggests that it is worthy of investigation whether it could not be made profitable for Washington to report as to novelty, not only to Canada, but also to England and to the other British Colonies having patent systems. However, as it is the standard of novelty accepted in any particular country, and not the form in which applications are filed there, that determines the value of the examiner's work, no useful purpose would be gained by the adoption of the proposals for instituting a single search. The legal standard of novelty accepted in this country has, from the inventor's point of view, many advantages over the standard adopted in the United States; therefore, by resorting to the protection of the British patent law inventors in our Colonies stand to gain. Further, in cases where the Colonies are unable to provide for efficient search for their own purposes, the proper remedy seems to be for the Imperial Government to make suitable arrangements for conducting patent searches in London on behalf of those Colonial Patent Offices which may desire to avail themselves of the exceptional facilities existing in this country for such a purpose.

DR. W. H. RIVERS has reprinted from the Bulletin of the John Rylands Library (vol. iv., 1918) a lecture entitled "Dreams and Primitive Culture." He discusses the most essential feature of Freud's theory, according to which "the dream as we remember it, and record or relate it—the manifest content of the dream—is the product of a process of transformation. By means of this process the motives producing the dream—the latent content of the dream, or the dream-thoughts—often find expression in a form differing profoundly from that by which they would be expressed in the usage of ordinary waking life." The next process, that of symbolisation, "implies a relation between the underlying motive of the dream and the form in which this motive is expressed, the relation being of such a kind that the image of the manifest dream is a concrete symbol of the thought, emotion, or sentiment which forms its latent motive." On this analogy, among savage peoples, dramatic representation goes far more deeply into the texture of their lives than would appear if we attend only to its place in religious ritual. This would go some way to explain why rude rites and customs have their origin in the unconscious, and it enables us to understand why it is impossible, among peoples of the lower culture, to obtain any rational explanation of rites and customs, even when such explanation seems to us to be obvious.

IN a recent issue of the *Rivista di Antropologia* Prof. Giuffrida-Ruggeri makes a contribution ("Se i popoli del mare delle iscrizioni geroglifiche appartengano tutti all' Italia") to the much-discussed problem of the identity of the Mediterranean peoples who took part in the conflicts with Egypt during the Nineteenth and Twentieth Dynasties. He agrees with A. J. Reinach as to the history of the Etruscans. As Seneca wrote, *Tuscos Asia sibi vindicat.* At the time of the great Mediterranean turmoil (thirteenth and twelfth centuries B.C.) the "Tursha" or Etruscans were among the people who set out from their Lydian home and attacked Egypt. "They came to the Nile Delta with their women and children, and were evidently looking for land to colonise, but were 'thrown into the sea' (*circa* 1260 B.C.) by the armies of Merenptah, and again by Ramses III. (*circa* 1190 B.C.). These failures must have diverted them in another direction, towards the barbaric regions of the west. So it was that about the eleventh century B.C. their boats reached the western peninsula, the fabled Hesperia, and they occupied Tuscany." But Prof. Giuffrida-Ruggeri disagrees with Reinach's claim that their Lydian neighbours, the Shardana, occupied Sardinia at the same time. His reason is that Sardinia was "a very difficult country to occupy, strongly fortified, and inhabited by a fierce population." The Sardinians were a Mediterranean people who "provided war material for the confederation of the 'peoples of the sea' who attacked Egypt. They took part in this attack with valour, such as their descendants have recently shown in the battles of the Isonzo."

In *Science* (vol. xlviii., No. 1250, December 13, 1918) Mr. S. O. Most discusses the problems, methods, and results of the study of behaviour. He thinks that from time to time it is advantageous to trace the course of scientific development and adjust plans for the future. He gives a historical review of the study of behaviour from the unscientific acceptance of the soul as the controlling agent of all activities—the current view of pre-Renaissance times—through the seventeenth-century belief in the purely mechanical action of men and animals—a belief which inspired much research—to the nineteenth-century realisation of the complex nature of the problem. The problem is a practical one, as is evidenced by the work of such societies as that of the anti-vivisectionists, who, though often inconsistent, yet base their activities on an assumption of the likeness between animals and man with regard to pain. The author urges the claims of a comparative study of behaviour in spite of its anthropomorphic tendencies. He thinks that the differences between the mechanists and vitalists are mainly verbal, the one believing that all reactions are completely determined by material configurations, the latter that the reactions are not thus completely determined, the differences, though, lying in an ambiguous use of mechanical reduction. Whichever view is held, the scientific worker is in equal degree bound to ascertain by experimental methods every possible sequence of phenomena ending in reactions. Hitherto all attempts to reduce animate responses to physico-chemical principle have resulted in evidence which shows that a great majority of such responses are, in a measure, mechanically determined. To ascertain the extent of this determination is an important problem both for the vitalistically and the mechanistically inclined men of science.

In the February issue of *Reveille* (No. 3) "Economist" discusses "the cost of consumption." The author points out that in ten years the deaths from tuberculosis in England and Wales are not far short of the total deaths in the British and Dominion forces during the war. He pleads for the extension of colony treatment, such as obtains at Papworth, where the consumptive, after a period of observation in a sanatorium, is allowed by slow degrees to begin working, preferably at his old occupation, or, if that is unsuitable, at some new occupation which does not require too long a period of training. After a few months, when ready to leave the sanatorium, and if a suitable case, the patient is encouraged to settle on, or in the neighbourhood of, the colony. This means subsidised labour, a costly matter, but probably no more costly than allowing the patient to die, while the ultimate gain by the reduced risk of infection is very great.

A paper by Harriette Chick, E. Margaret Hume, Ruth F. Skelton, and Alice Henderson Smith on the prevention of scurvy (*Lancet*, November 30, 1918) is of some botanical as well as medical interest. "Lime-juice" has a well-known reputation as an antiscorbutic, dating from the eighteenth century, and there is every reason to believe that it was, in fact, the use of "lime-juice" which was responsible for the disappearance of scurvy from the British Navy in the early part of the nineteenth century. Towards the end of that period, however, various Arctic explorers became sceptical about its value, and it has been subjected to much adverse criticism as a prophylactic or therapeutic agent in the late war. The authors found in animal experiments that the current lime-juice is of very little value, but that lemon-juice is effective in preventing scurvy in guinea-pigs. The historical researches of Mrs. Henderson Smith cleared up the puzzle. The original "lime-juice" came from the Mediterranean, and was derived partly from the sweet lime (*Citrus medica* var. *limetta*), but chiefly from the lemon (*C. medica* var. *limonum*); it was what we should now call "lemon-juice." About 1865 the cultivation of the sour lime (*C. medica* var. *acida*) had become a considerable business in the West Indies, and the Admiralty patriotically transferred its contracts from Malta and Sicily to English firms; they got what we now call "lime-juice," and it was useless. In the same series of nutritional investigations made at the Lister Institute, Harriette Chick and Mabel Rhodes (*Lancet*, December 7, .918) direct attention to the fact that the most potent antiscorbutics are all crucifers—cabbage, "scurvy grass" (Cochlearia), and "cresses" of various kinds; swedes are much more efficient than carrots (Umbelliferæ) or beetroots (Chenopodiaceæ).

The efforts made to introduce the use of bracken rhizomes as food for stock do not receive much encouragement from the results of experiments with pigs and poultry reported in Bulletin No. 89 of the West of Scotland Agricultural College. In the experiments with pigs an increased live-weight was certainly secured by the use of the bracken rhizomes, but this represented only a very meagre return. In the case of poultry the results as indicated by egg-production were entirely disappointing. In both cases the experiments were admittedly not on a sufficient scale to warrant definite conclusions, but the outlook for the promotion of bracken to the dignity of a fodder crop does not appear hopeful.

Mr. G. T. Moore (Annals of the Missouri Botanical Garden, vol. v., No. 3, 2 plates, 1918) gives an account of a new wood-penetrating alga, *Gomontia lignicola*, found on a yellow-pine board in a fresh-water pond near Woods Hole, Massachusetts, the study of which has cleared up several points in the life-history of the genus. The plant consists of unbranched cylindrical filaments in which a striking appearance is produced by the concentration of most of the chlorophyll in the terminal cell, the remaining cells being so devoid of colour as to have the appearance of a fungal hypha. The plant is reproduced by zoospores, which are formed in large numbers in sporangia of extremely irregular outline, and either germinate directly to produce a new filament or form resting-spores. The latter are very irregular in size and shape, brilliantly green and full of starch, and may rest for months, or even years, before germination.

One of the most destructive of recent Italian earthquakes, of which little was heard at the time, occurred in the Upper Tiber valley on April 26, 1917, at 9.40 a.m. (G.M.T.). Though the area of damage, according to Prof. Oddone (*Boll. Soc. Sis. Ital.*, vol. xxi., 1918, pp. 9–27), contains only about seventy-five square miles, there was within it a small district in which the intensity of the shock surpassed the highest degree (10) of the Mercalli scale the destruction of houses being as complete as at Messina in 1908 and Avezzano in 1915. The epicentre of this earthquake is in 43° 28·2 N. lat., 12° 7·7′ E. long., and it is evident that the focus was at a slight depth Among the after-shocks was one of less, but still ruinous, intensity, which occurred on April 27 at 2.30 p.m. (G.M.T.).

Mr. R. M. Deeley has sent us a copy of a paper contributed by him to the *Philosophical Magazine* for March, 1918, in which he discusses the temperature distribution in a cyclonic depression, and puts forward a hypothesis as to the causation of these depressions. Upper-air research by means of sounding balloons has shown that in the troposphere the core of a cyclone is cold relatively to the surrounding air, whereas at greater heights, in the stratosphere, the reverse is the case, the air being relatively warm. It is suggested that this warmth probably extends to the confines of the atmosphere. The author considers that the air which flows spirally inwards in the lower layers rises in the central region of the cyclone to great heights, flowing outwards in the higher levels of the stratosphere. This circulation being postulated, it remains to find some means by which the column of rising air in the stratosphere may be warmed, and this Mr. Deeley ascribes to the action of a pencil of high-velocity cosmic matter which strikes and heats the outer part of the atmosphere in a localised patch. The heating is regarded as being produced rapidly and as dying away slowly. According to this theory, cyclones must travel with the winds of the upper atmosphere, which carry the heated core with them. No attempt is made to explain how a cyclone can persist for days, or even weeks, as it travels over the surface of the earth.

At a meeting of the Institution of Civil Engineers on March 12 three papers were read on electric welding developments. There are three systems in general use. In "spot" welding the metals to be soldered together are placed in contact and an electric current sent between them. This method is rapid and efficient, and is easily performed by unskilled labour. In "seam" or "line" welding, mechanically driven roller electrodes are used; and in the "carbon-arc" process the metal is melted by means of the electric arc. It was pointed out that electric welding would be particularly helpful in the automobile industry, as crank-shafts, broken or worn teeth of gear-wheels, and gear-cases can rapidly be renovated. In shipbuilding it was stated that electric-arc welding has proved successful for forging, riveting, and caulking. It has been found possible to join thick steel plates by welding more economically than by riveting. Experiments showed that in the case of butt-welds the tensile strength of the joints was from 90 to 95 per cent. of that of the solid plate. In the "carbon-arc" process the carbon rod formerly used has now been replaced by an iron welding pencil, which is found to be far more suitable.

The March issue of the *Geographical Journal* contains a paper by Mr. E. A. Reeves, the map curator of the Royal Geographical Society, on "A Transformation of the Magnetic Dip Chart." The transformation carried out by Mr. Reeves consists in drawing lines through those places on the earth's surface at which the axis of the dip-needle makes equal angles with the axis of the earth instead of with the horizontal plane through the place of observation. This plan gives more regular lines, which approximate to circles having an axis inclined at 3° to 5° to that of the earth. In a contribution to the discussion on the paper Dr. Chapman pointed out that whatever axis were taken as that from which to measure the inclination of the dip-needle, the curves of equal inclination would approximate to circles about an axis between that chosen and the magnetic axis, so long as the earth approximated to a uniformly magnetised sphere. Dr. Chree also pointed out how closely the earth corresponds with a sphere uniformly magnetised about an axis inclined at 12° to the geographic axis. The paper and discussion point to the desirability of taking as the axis of reference the magnetic rather than the geographic axis of the earth.

"Experiments with Clay in its Relation to Piles" was the subject of a paper by Mr. A. S. E. Ackermann read before the Society of Engineers on March 10. The experiments described deal on a small scale with the resistance of clay to penetration by discs, pyramids, and cylinders. In one test a cylinder of clay 2 cm. in diameter and 68 cm. in length, fixed at one end and twisted at the other through $37\frac{1}{2}^\circ$, recovered when released through 32°, which is taken to be a proof of the elasticity of clay. The resistance to penetration (without shock) increases as the water-content diminishes. If $W+w$ is the resistance to penetration and V the volume of penetration, then for pyramids $V=a(W+w)^n$, where n is about 1·5. In the case of discs at critical loads the disc started and continued to sink in the clay, the pressure, taken to be the pressure of fluidity, being on the average 587 grams/cm.^{2}, the water-content being 29 per cent. The general conclusions are:—(1) For tapered bodies the load for a given penetration is proportional to the area of surface of contact; (2) it is much greater the less the percentage of water in the clay; (3) the pressure of fluidity is less when the percentage of water is greater; (4) tapered piles support a greater load than parallel-sided piles; and (5) pointed piles are more efficient than blunt. In the application of these results to practice it must be remembered (apart from the small scale of the tests) that the clay with which an engineer deals is less homogeneous than the puddled clay employed; that piles are driven by impact, which disturbs the earth round the pile; and that the important point is not the resistance when driving, but after a period when the earth is more or less resettled. The tests are, however, interesting to physicists and engineers.

A suggestion was made a few days ago during a sitting of the Coal Commission that if higher wages were to be paid to miners, manufacturers would be driven to America or Sweden to seek the advantages of water-power. The allusion to Sweden is striking testimony to the rapid developments which are now taking place in the hydro-electric installations of that country. *Engineering* has from time to time published particulars of these enterprises (reference has also been made to them in these columns), and in its issue of March 7 it has a long article dealing with the impending extension of hydro-electric power schemes under the auspices of the Royal Swedish Waterfalls Board. A power station is projected in Lapland with a capacity of 192,500 kw., having its source in the chain of lakes, the lowest of which, Storea Lulea, finds an outlet in the River Lule. The river is about 100 miles in length, and debouches into the Gulf of Bothnia, just below the Arctic Circle. Two important falls on the river are the Porjus and the Horsprauget. The former has already been utilised to a considerable extent; the load, so far as three-phase current is concerned, amounts to 15,000 kw., and when certain extensions have been effected will reach double that figure. The Horsprauget project will furnish an additional estimated capacity of 192,500 kw. The falls, of which there are several in series, will be impounded in a single installation by the construction of a high dam, which will have the distinction of being larger than any hitherto constructed in Sweden. It will be 1 kilometre (1100 yards) long and about 40 metres

(130 ft.) above the ground at its highest point. By lowering the water-level two metres, a supply of 5,000,000 cubic metres (say 1,100,000,000 gallons) will be available, which is sufficient to equalise load variations during a period of twenty-four hours. The dam will be designed as a composite structure, with special features to resist ice-pressure, which is, of course, a vital consideration in such high latitudes. The aggregate surface area of all the lakes within the catchment area amounts to about 890 sq. km. (343 sq. miles), and the total catchment area to 9860 sq. km. (3805 sq. miles).

OUR ASTRONOMICAL COLUMN.

Venus and Jupiter.—The planets Venus, Jupiter, and Saturn are now finely displayed in the evening sky. Venus is situated in Aries, Jupiter in Gemini, and Saturn in Cancer. To the naked eye a very interesting spectacle will be afforded during the ensuing few weeks by the approach of Jupiter and Venus. At present they are distant about 60° from each other, but this interval is decreasing at the rate of slightly more than 1° each night. This is due to the easterly movement of Venus. It will prove an entertaining incident to watch the gradual approach of the two planets until their conjunction on the night of May 25, when they will be very little more than 2° distant from each other near the time of their setting at about 11.11 p.m.

Comets of the Jovian Family.—Schorr's comet (*d* 1918) adds another member to the ever-increasing group of short-period comets. Forty of these objects were previously known, but fewer than half of this number had been fully confirmed by observations of a second return to perihelion. Two orbits have been computed for Schorr's comet which differ in the period assigned, one giving 6·73 years and the other 5·86 years. Definitive elements will, no doubt, be calculated when the comet has passed beyond the range of further observations.

Star Clusters.—Dr. C. V. L Charlier has made an investigation of the distances and configuration of clusters (Meddelanden, Lund Observatory, ser. ii., No. 19). Making the simple assumption that distance varies inversely as angular diameter, he finds a grouping of the non-globular clusters strikingly similar to that which he found some years ago for the B stars. This is a satisfactory confirmation of the previously accepted conclusion that the non-globulars are intra-galactic objects. Since the centres of the two systems (non-globulars and B stars) are in the same direction from the sun, it is a reasonable assumption that they are coincident, which enables the scale of the non-globular system (at first left arbitrary) to be determined. A second determination, fairly accordant with the first, is made by assuming the extent of the system in a direction perpendicular to the plane of the galaxy to be the same as that found for the B stars. In the galactic plane the distances range to 5000 L.Y., but the great majority are less than 3000. The greatest co-ordinates perpendicular to the plane are about 1600 L.Y., indicating the usually accepted bun-shaped figure. It is evident that the distances of individual clusters cannot be relied on, but it is interesting to note that the distance of the great double cluster in Perseus comes out as 400 L.Y., which is close to the distance deduced for Nova Persei from the rate of illumination of the surrounding nebula.

Treating the globular clusters in the same way, Dr. Charlier finds a configuration similar to that found by Dr. Shapley, but on the question of scale he is in strong opposition to him, insisting on the intra-galactic situation of the globulars, owing to their concentration in the great star-cloud of Sagittarius, and other features of their grouping. He is thus led to take the absolute magnitude of the brightest cluster stars as about +8, and to assert that the cluster variables are dwarfs, though the Cepheids with their similar light-curves are admittedly giants. Prof. Eddington's researches make it unlikely that stars of small mass could attain a sufficient temperature to have a negative colour-index, such as Dr. Shapley found in many of the cluster stars. However, the results of the latter are of such a startling and far-reaching character that it is all to the good, in the interests of the attainment of truth, that an astronomer of Dr. Charlier's eminence should hold a brief for the other side pending further light on some of the weaker links in Dr. Shapley's chain of reasoning.

WEATHER INFLUENCES ON THE WAR.

PROF. ROBERT DE C. WARD contributes an article on "Weather Controls over the Fighting during the Autumn of 1918" to the *Scientific Monthly* for January. This is the concluding communication of a series which has from time to time been noticed in Nature, and deals with the weather to the time of the signing of the armistice by Germany. The author states his belief that "as a part of the scientific history of the great war, as full an account as possible should be kept of the meteorological conditions which affected the operations on all the battle-fronts."

The autumn of 1918 is stated to have been "in many respects the most critical season, meteorologically, of any period of equal length during the whole war." It was clear that the Allies were determined to force the defeat of the Germans whilst fighting weather lasted. The Allies, by pushing on, were gaining better ground and more shelter for their armies.

At the commencement of September despatches mentioned the "unprecedented dryness" which for about a week favoured the movements of the Allies, but the second week of September experienced heavy storms, which retarded progress. Throughout the war as autumn advanced the fighting conditions were less favourable, and the Flanders mud had proved an almost insurmountable obstacle. The distribution of the rainfall throughout the year at the Western Front is similar to that over the south-east of England, where the heaviest rains occur in the autumn season, the average rainfall of October being equal to that of February and March combined. Add to these conditions the drop of temperature, which on the Continent is much greater than in the British Isles, and the colder weather brings more snow and slush. The rivers are not uncommonly in flood, and, wherever possible, the enemy caused artificial flood, hampering and impeding the movements of the Allies.

Official despatches laid unusual stress on the unfavourable weather controls of the autumn, but probably much of this was due to the intense anxiety of the Allies to crush the enemy before winter set in. All bad weather was helping the enemy by delaying attack and enabling him to organise his retreat. The Monthly Weather Report of the Meteorological Office for September shows that the month was abnormally wet and very cold, whilst in many parts of England "the rainfall totals were the greatest ever measured, not only in September, but in any calendar month whatever." The map showing the movements of